an oblique view revealed a fracture of the medial malleolus (Fig 11).

Case 4 A woman of 29 injured her right ankle when she fell over a pram. The clinical features suggested a very moderate injury to the ankle but there was tenderness clearly located to the medial malleolus. Only the oblique view showed the fracture (Fig 12).

Reconstruction of the Anterior Cruciate Ligament by the Method of Kenneth Jones (1963)

by Lieutenant Colonel D J Cowan OBE FRCS RAMC

Extension of the knee-joint through the last 10 degrees can take place only if the anterior cruciate ligament is relaxed by lateral rotation of the lower leg. For the first 10 degrees of flexion of the knee-joint, a corresponding medial rotation of the tibia on the femur is necessary. The next 10 degrees of either flexion or extension is a purely rolling movement. Beyond this range the point of contact on the tibial profile is constant, while that on the femur gradually wanders backwards.

The anterior cruciate ligament has a wide attachment inferiorly to the anterior aspect of the intercondylar area of the tibia and inclines upward, backwards and laterally, invested by a layer of synovial membrane to a fan-shaped superior attachment on the posterior part of the medial surface of the intercondylar notch of the femur. The classical view, stated in many anatomy textbooks, is that the ligament is tight in extension and loose in flexion. Certainly the greatest tension in extension affects the anterior fibres; at the beginning of flexion the anterior fibres relax and the middle fibres are tense. On full flexion the postero-lateral fibres are tense (Fig 1).

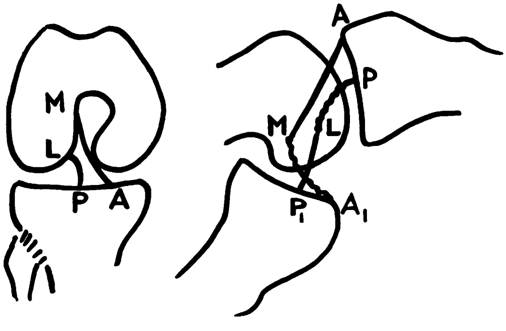

Fig 1 *The normal arrangement of the fibres of the anterior cruciate ligament.* A–M, *antero-medial fibres.* P–L, *postero-lateral fibres*

Where a meniscus is torn, and the displaced portion of the meniscus prevents the rotational movement of the tibial plateau on the femur, it

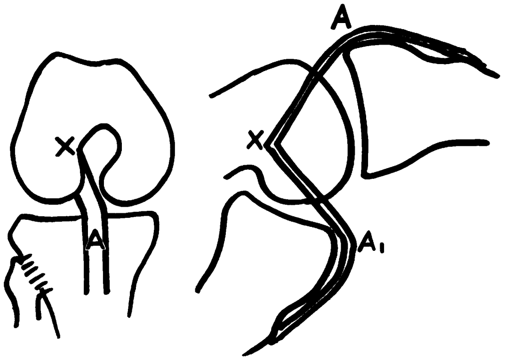

Fig 2 *The reconstructed ligament, from the middle third of the patella ligament, slice of patella and one inch of the quadriceps tendon.* A–X, *reconstructed ligament.* A, *site of entry of ligament into the knee-joint.* X, *situation of drill hole in the lateral femoral notch, through which the ligament leaves the joint*

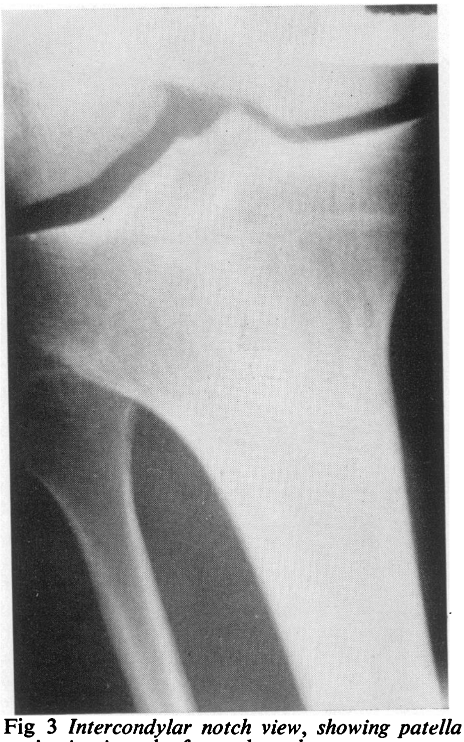

Fig 3 *Intercondylar notch view, showing patella slice projecting into the femoral notch*

prevents full extension. If extension is then forced the anterior cruciate will be ruptured, commencing with the anteromedial fibres. This often occurs in instalments, until the ligament is completely ruptured.

Brantigan & Voshell (1941) described the function of the ligament as follows. It controls: (1) Forward gliding of the tibia. (2) Lateral mobility in extension in conjunction with the capsule and posterior cruciate ligament. (3) Lateral mobility in flexion in conjunction with the capsule, posterior cruciate ligament and medial ligament. (4) Rotation in extension with the capsule and the posterior cruciate ligament. (5) Rotation in flexion with the capsule, posterior cruciate and medial ligaments. (6) Hyperflexion. (7) Hyperextension.

Many operations have been devised to reconstruct this ligament and certainly from the multiplicity of its actions it would be difficult to produce a new ligament of the complexity of the normal anatomical arrangement of the anterior cruciate ligament.

McMurray (1919) used semitendinosus tendon to replace the medial ligament of the knee and Helfet (1948) modified this procedure by cutting a single groove in the femur in the line of the anterior cruciate ligament, permitting the tendon to run freely in it.

Hey Groves (1917) described an intra-articular repair with fascia lata; this repair has been adapted and modified by O'Donoghue (1963).

Blair (1942) described a method of extra-articular stabilization using fascia lata. The operation is based on the observation that the axis of rotation is situated in the posterior portion of the femoral condyle.

Smillie (1962) used the medial meniscus to replace the ruptured anterior cruciate ligament in 20 cases, with satisfactory results. However, he states that it is possible that the best results occurred when the operation was not really necessary.

O'Donoghue (1963) stated that the majority of reconstructions did not appear to be worth while. Repair was only advised in anterior cruciate instability sufficiently severe to interfere with normal everyday living. Twenty-nine patients are reported in his series with a fair degree of success. This is, however, rather a formidable procedure, utilizing the full length of the iliotibial band.

Kenneth Jones (1963) described a method of intra-articular repair using the middle third of the patella tendon to replace the ligament. This is left attached to a strip of patella and quadriceps tendon to give the necessary length. The strip of patella, removed without damage to the articular surface, is introduced and secured in a channel drilled through the lateral femoral condyle.

While isolated rupture of the anterior cruciate ligament often produces no serious disability, there are a small proportion of patients who suffer from recurrent instability and effusion with only moderate activity. In the Services this may well jeopardize their career. I have now performed this repair on 7 such patients, all active young servicemen with symptoms of more than six months' duration, who were unable to undertake full duties with their units. They have been followed up for periods ranging from nine to eighteen months. Five have been able to return to full regimental duties, including participation in active sport. All achieved a full range of knee movement, with absence or marked decrease in the 'drawer' sign. Two patients, who also had collateral ligament instability, were not improved by this procedure and eventually had to be invalided.

Some modifications to the technique described by Kenneth Jones have been made. I attach great importance to the situation of the drill hole in the femoral notch. This must be so placed in the lateral side of the notch that the substitute ligament remains firm throughout the full range of flexion and extension and does not limit this range (Fig 2). I use a dental scaler to judge this position, placing it along the line of the new ligament and hitching the sharp point into the lateral condyle, while the knee is moved through its full range. I also use a drill guide so that the canal can be drilled from without inwards. This avoids damaging the articular cartilage of the medial femoral condyle.

The distal pole of the patella slice projects into the intercondylar notch (Fig 3). Jones recommends that this be rongeured away, but as this would clearly weaken the new ligament, and as in my cases it has not projected sufficiently to interfere with movement, I have not done this. In a personal communication, Jones states that, when the knee is flexed to a right angle, there is frequently a positive 'drawer' sign, which consistently diminishes as the leg is brought into an extended position. The ligament is therefore reproducing the function of the antero-medial fibres only. It is possible to place the ligament in such a position that it remains firm throughout the full range of movement and thus contributes to stability in all positions. Another point is that the only clinical sign of a satisfactory repair is the absence of a 'drawer' sign.

To summarize: In the majority of cases, isolated rupture of the anterior cruciate ligament produces little disability and does not call for treatment other than the development of the quadriceps muscle, but in the small proportion of cases where there is persistent and troublesome instability because of this lesion, I consider this repair has a useful place.

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Experiences with Intravenous Regional Anæsthesia

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Almost a century has passed since local anæsthetics were first injected intravascularly. According to Allen (1914) intra-arterial injections of cocaine were carried out in a frog by Alms in 1866 and in man later by Appel and Goyanes. In both cases analgesia of the extremity was produced. It was not until 1908 that Bier used what he described as 'venous anæsthesia' in 134 cases with no adverse side-effects. Although several series were reported during 1909 (Page & MacDonald, Hitzrot, Hartel, Catz), with the exception of Adams (1944) and Lee (1959) the method is given little attention in anæsthetic textbooks. Several series of cases have been published during 1963 (Bell *et al.*, Holmes) and 1964 (Adams *et al.*, Cox), each varying the method slightly. Many surgeons and anæsthetists still seem unfamiliar with the procedure and when it may be applied, particularly in orthopædic and traumatic surgery.

The present series is intended to show the convenience, simplicity, safety and efficiency of the method, and the manner in which it can be used with good effect for major and minor acute, traumatic or elective surgery on the extremities.

Method: After the surgeon has examined the patient to check on which limb the operation is to be performed, the anæsthetist explains to the patient exactly what is going to be done and what he can expect to feel. It is important to gain the patient's confidence and to reassure him throughout the procedure that all is going according to plan. If this is done, pre-operative sedation is rarely necessary.

Several turns of orthopædic wool are wrapped round the upper arm or calf and a sphygmomanometer cuff is placed over the wool and is secured in position with a cotton bandage. The wool is necessary to reduce any unpleasant sensations due to pressure from the tourniquet and the bandage is used to ensure that the cuff does not become undone during the operation. The blood pressure is then taken and the cuff left at a point just above the diastolic pressure to produce venous engorgement and facilitate the insertion of an indwelling needle into a vein: after preliminary infiltration of the skin with 0·5% lignocaine, a Mitchell needle is inserted into any convenient vein that does not interfere with the operation site; the needle should be washed through, to prevent clotting, and is then secured to the skin with strapping. (In this series 2 ml of 0·5% lignocaine was used to flush the needle through, providing a test for hypersensitivity to the drug before the main dose is given.) After elevation of the limb for several minutes, an Esmarch rubber bandage is used to exsanguinate the limb and the cuff is inflated to 50 mm above the systolic pressure. The bandage is omitted when the condition is a painful one, such as a fracture. Care must be taken not to disturb the position of the Mitchell needle during this exsanguination manœuvre. The Esmarch bandage is then removed and 40 ml of a 0·5% solution of plain lignocaine is injected intravenously using the Mitchell needle. The skin begins to take on a blotchy purplish appearance and paræsthesiæ are soon felt by the patient. Within five to seven minutes anæsthesia to pain is complete although other sensation, such as touch, may remain for a time. This period may be shortened slightly if the patient clenches and unclenches his fist several times; in larger limbs another 5–10 ml of the solution may have to be injected.

The operation may begin as soon as sensation